# DATA SHEET

LATROBE SPECIALTY STEEL COMPANY
Latrobe, PA 15650-0031 USA

*Issue 1*

# **14-4CrMo** Stainless Tool Steel

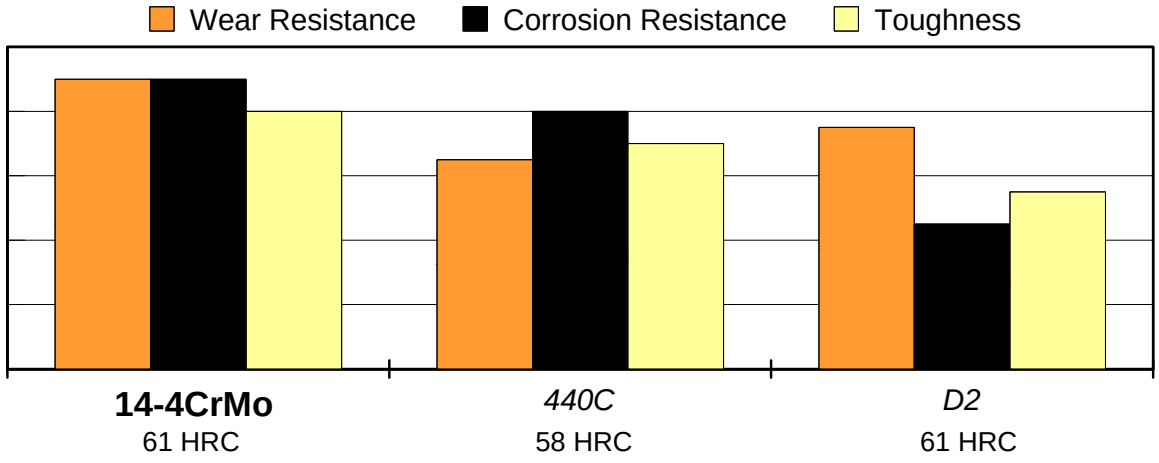
Typical Composition

| C | Mn | Si | Cr | Mo |
|---|---|---|---|---|
| **1.05** | **0.50** | **0.30** | **14.00** | **4.00** |

**14-4CrMo** is a wear resistant, martensitic stainless tool steel that exhibits better corrosion resistance than Type 440C stainless steel. The molybdenum in the steel provides superior corrosion resistance compared to some higher-chromium stainless steels. The combination of the high carbon and molybdenum contents results in the formation of hard, wear-resistant molybdenum carbides in the microstructure of the steel. These molybdenum carbides provide superior wear resistance and edge retention for cutting tools and knives.

Typical applications include knife blades, bearings, valve components, and bushings.

## Relative Properties




## Physical Properties

Density: 0.281 lb/in$^3$ (7780 kg/m$^3$)
Specific Gravity: 7.78
Modulus of Elasticity: 30x10$^6$ psi (207GPa)

Thermal Conductivity

| Temp. °F | Btu/ hr-ft-°F | Temp. °C | W/ m-°C |
|---|---|---|---|
| 200 | 14.0 | 392 | 24.2 |

Coefficient of Thermal Expansion:

| Temperature °F | in/in/ °F x 10$^{-6}$ | Temperature °C | mm/mm/ °C x 10$^{-6}$ |
|---|---|---|---|
| 68 - 212 | 5.7 | 20 - 100 | 10.3 |
| 68 - 600 | 6.0 | 20 - 316 | 10.8 |

Machinability: 60-65% of a 1% carbon steel

# 14-4CrMo
# HEAT TREATING INSTRUCTIONS

(See Tech-Topics Bulletin 102 for a more thorough explanation of heat treating.)

## HARDENING:

**Preheating:** Heat to 1100-1250°F (593-677°C), and equalize. Then heat to 1400-1450°F (760-788°C) and equalize.

**Austenitizing (High Heat):** Heat rapidly from the preheat to 1900 to 2000°F (1038 to 1093°FC).

Soak at the austenitizing temperature for 45 minutes for thicknesses up to 1 inch (25.4 mm), plus 15 minutes for each additional inch (25.4 mm) of thickness over one inch (25.5 mm).

**Quenching:** Air, pressurized gas, or warm oil.

For pressurized gas, a minimum quench rate of approximately 50°F (28°C) per minute to below 1000°F (538°C) is required to obtain the optimum properties in the steel.

For oil, quench until black, about 900°F (482°C), then cool in still air to 150-125°F (66-51°C).

**Cryogenic Treatment:** An optional cryogenic treatment may be used immediately after quenching to 150 to 125°F (66-51°C). Cool to -100°F (-73°C), remove from cooling medium, and allow part to warm to ambient temperature in still air.

**Tempering:** *Temper immediately after quenching, or after quenching and cryogenic treatment*.

Typical temperature range is 400-800°F (204-427°C). Hold at temperature for 2 hours then air cool to ambient temperature. Double tempering is recommended. **Do not temper between 800 and 1100°F (427 to 583°C).** Tempering in this range will decrease corrosion resistance and impact toughness.

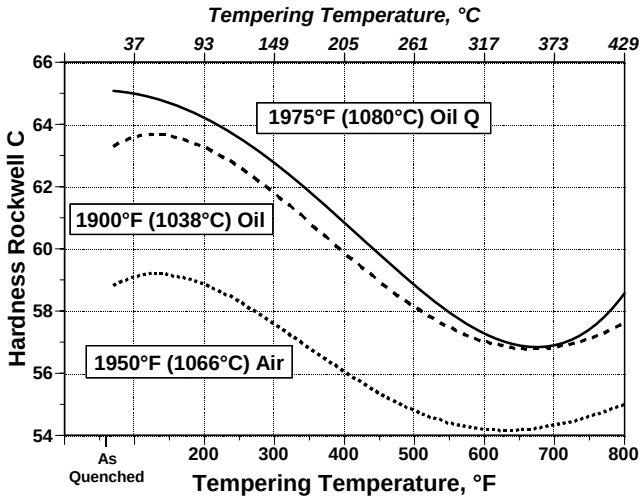
## ANNEALING:

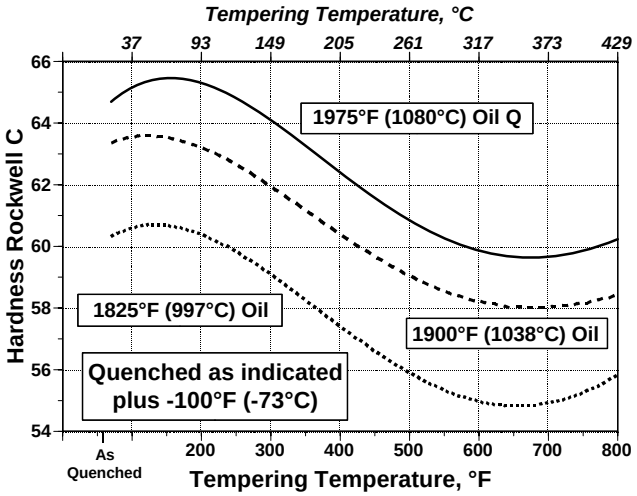
Annealing must be performed after hot working and before rehardening.

Heat at a rate not exceeding 400°F per hour (222°C per hour) to 1650°F (899°C), and hold at temperature for six hours. Then cool slowly with the furnace at a rate not exceeding 25°F per hour (14°C per hour) to 1200°F (649°C). Continue cooling to ambient temperature in the furnace or in air. The resultant hardness should be approximately 235 HBS.

## HEAT TREATMENT RESPONSE

| As Oil Quenched from | HRC |
|---|---|
| 1850°F (1010°C), 45 minutes | 60 |
| 1900°F (1038°C), 45 minutes | 63.3 |
| 1950°F (1066°C), 45 minutes | 63 |
| 1975°F (1080°C), 45 minutes | 62.5 |
| 2000°F (1093°C), 45 minutes | 61 |
| As Oil Quenched with cryogenic treatment at -100°F (-73°C) | |
| 1850°F (1010°C), 45 minutes | 60.5 |
| 1900°F (1038°C), 45 minutes | 63.5 |
| 1950°F (1066°C), 45 minutes | 64.5 |
| 1975°F (1080°C), 45 minutes | 65 |
| 2000°F (1093°C), 45 minutes | 65.5 |

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The data presented herein are typical values, and do not warrant suitability for any specific application or use of this material. Normal variations in the chemical composition, the size of the product, and heat treatment parameters may result in different values for the various physical and mechanical properties.


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